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ART UNIT	**PAPER NUMBER**
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Please find below and/or attached an Office communication concerning this application or proceeding.

PTO-90C (Rev. 10/03)

Office Action Summary	Application No.	Applicant(s)
	09/759,150	HAMILTON, CHRIS H.
	Examiner	Art Unit
	Kevin Siangchin	2623

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☐ Responsive to communication(s) filed on _____.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-12* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☒ Claim(s) *7* is/are allowed.

6)☒ Claim(s) *1,3,4,8-10 and 12* is/are rejected.

7)☒ Claim(s) *2,5-6,8,11* is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☒ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *16 January 2001* is/are: a)☐ accepted or b)☒ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. §§ 119 and 120

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

13)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application) since a specific reference was included in the first sentence of the specification or in an Application Data Sheet. 37 CFR 1.78.

a) ☐ The translation of the foreign language provisional application has been received.

14)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121 since a specific reference was included in the first sentence of the specification or in an Application Data Sheet. 37 CFR 1.78.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)

2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)

3) ☒ Information Disclosure Statement(s) (PTO-1449) Paper No(s) 2.

4) ☐ Interview Summary (PTO-413) Paper No(s). _____.

5) ☐ Notice of Informal Patent Application (PTO-152)

6) ☐ Other: .

Detailed Action

Drawings

Objections

1. The drawings are objected to because:

   a. In Figures 1-3, the reference numbers and various other captions are too light to be reproduced and are in some cases illegible (e.g. first functional block in Fig. 1).

   b. The dashed boxes of Fig. 3 are drawn in such a way as to render the units, which they demarcate, indiscernible.

   c. The lines indicating the logical flow of the JPEG image compressor depicted in Fig. 3 are difficult to follow. The lines near the center of Fig. 3 are particularly heinous.

   d. The formulas listed in several of the functional blocks depicted in Fig. 3 are difficult to read. For example, see the formula for S_{ij} and the formula in block 118.

   e. Though S_{ij} in Fig. 3 is apparently attributed to one of the flow lines within its vicinity, it cannot be determined from the drawing which one(s) of those lines S_{ij} is actually attributed to.

A proposed drawing correction or corrected drawings are required in reply to the Office action to avoid abandonment of the application. The objection to the drawings will not be held in abeyance.

Specification

Objections

2. The disclosure is objected to because of the following informalities.

   a. On page 3, lines 20-21 of the applicant's disclosure, the applicant recites: "The difference between Y_{mn} and Y_{mn} represents lost image information causing distortion to be introduced". This difference is trivially 0. However, it is clear from the preceding parts of the disclosure that the applicant intended the following: "The difference between reconstructed Y_{mn} and the originally

transformed coefficients Y_{mn} represents lost image information causing distortion to be introduced".

b. On page 8, line 25 of the applicant's disclosure the following formula appears:

$$A_{mn} \underset{V(i,j)}{=} \bullet I_{ij}(B_{ij})_{mn}$$

Clearly this is a typographical error.

c. On page 9, line 11 of the applicant's disclosure, T_{ijm} is used where T_{ijmn} was intended.

d. On page 14 of the applicant's disclosure, the convolution formula for H_{ij}, $H_{ij} = \sum_{m,n} V_{i-m,j-m} G_{ij}$ is incorrect. First, it is unclear as to what the indices of summation are. If the summation is performed over all m and n, then for H to be a convolution of V and G, the proper expression for the ij-th element of H is, $H_{ij} = \sum_{\forall m,n} V_{i-m,j-m} G_{mn}$. Note also that the preceding usage of the indices, i and j, in the applicant's disclosed formula for H_{ij} can be misleading. The formulas listed here and in the disclosure imply that H_{ij} is the ij-th element of a 2D convolution. However, H_{ij} is already used in the applicant's disclosure to represent this convolution between the Laplacian edge kernel G and the window V_{ij} where the indices, ij, are associated with the ij-th image block, B_{ij}. See page 13 of the applicant's disclosure. Usage of a different set of indices to indicate an element of the matrix, H_{ij}, would resolve any potential confusion.

Appropriate correction is required.

Claims

Objections

3. Claims 1-2, and 6-10 are objected to because of the following informalities.

a. Claim 1 item (e) indicates the division of by a matrix, S_{min}*Q. It is clear that the applicant intended the division by S_{min}*Q_{mn}. Claims 2, 6-8, and 10 are similarly objected to.

b. In claim 6, the following formula $A_{mn} = \underset{(i,j)}{\bullet} I_{ij}(B_{ij})_{mn'}$ appears to be a typographic error. $(B_{ij})_{mn'}$ and the operation $\underset{(i,j)}{\bullet}$ are undefined. For the remainder of this document it will be assumed that the intended formula is: $A_{mn} = \sum_{\forall i,j} I_{ij}(B_{ij})_{mn}$.

c. Claim 7, item (d) contains the formula, $S_{ij} = l_{ij}(S_{max} - S_{min})$. Clearly, $S_{ij} = I_{ij}(S_{max} - S_{min})$ was intended.

d. Claim 7, item (f) contains the expression $Q{*}S_{min'}$ where $Q{*}S_{min}$ was intended.

e. Claim 8 contains two items labeled (a).

f. Item (a) of claim 8 recites "shrinking the colour channels U and V by a fraction of their size". This terminology is misleading. Item (a) of claim 8, as written, seems to indicate that the dimensions of the image, or at least the UV component thereof, are reduced. When interpreted in this manner, claim 8 is not consistent with the specification. However, it is clear from the disclosure that the applicant intended item (a) of claim 8 to indicate that the color channels U and V are subsampled at some fixed ratio relative to the color channel. The "shrinking factor" o f claim 9 is similarly objected to.

Appropriate correction is required.

Rejections Under U.S.C. § 112(2)

4. The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

5. Claim 6 is rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. Claim 6 recites the limitation "said Q". Worded as such, claim 6 has multiple antecedents (i.e. the said Q can refer to that which is defined in claim 1 item (i) or claim 1 item (ii)). It is unclear, in claim 6, as to whether the applicant is referring to the Q defined in item (i) of claim 1 or item (ii) of claim1. It is assumed subsequently in this document that said Q refers to the global quantization matrix Q defined in item (ii) of claim 1.

Rejections Under U.S.C. § 103(a)

6. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

7. Claims 1, 3, 8-10, and 12 are rejected under 35 U.S.C. 103(a) as being unpatentable over Konstantinides et al. (U.S. Patent 6,314,208), in view of Yovanof et al. (U.S. Patent 5,677,689).

8. *The following is in regard to claim 1.* Note that the image compression system proposed by Konstantinides et al. implements an image compression algorithm that is JPEG compliant (Konstantinides et al. column 2, last paragraph). Therefore, by adhering to the JPEG standard, the following aspects of that algorithm can be regarded as inherent.

The algorithm, upon which the Konstantinides et al.'s disclosed system is based, is a method of JPEG compression of an image frame divided up into a plurality of non-overlapping, tiled 8 × 8 pixel blocks B_{ij} where i, j are integers covering all of the blocks in the image frame. Note that Konstantinides et al. use y_i to denote these blocks (Konstantinides et al. column 4, last paragraph). B_{ij} and y_i will be used interchangeably throughout this document. The method comprises:

a. Forming a discrete cosine transform (DCT) of each block y_i of the image frame to produce a matrix of blocks of transform coefficients D_{ij}. Note that Konstantinides et al. use Y_i to denote such a matrix of blocks of transform coefficients (Konstantinides et al., column 5, paragraphs one and two). D_{ij} and Y_i will be used interchangeably throughout this document.

b. Calculating a visual importance, I_{ij}, for each block of the image. The activity measure M_i calculated for each block i can be regarded as a measure of visual importance for block i. See Konstantinides et al. column 5, last two paragraphs, column 6, lines 27-54, and column 7, lines 45-56.

Although Konstantinides et al. do not limit the range of M_i to the interval [0,1], as the applicant does, it can be seen from the formula in column 6 and the pseudocode listed in column 7 of Konstantinides et al. that $M_i \geq 0$. Konstantinides et al. suggest a practical range for M_i derived from empirical data. See Konstantinides et al. column 7, lines 42-44. Furthermore, note that a higher M_i suggests a higher activity, which, in turn indicates a block of higher visual importance. Similarly, a lower M_i suggests a lower activity, which, in turn indicates a block of low visual importance. This is consistent with the I_{ij} of the applicant's claimed method. It would be trivial for one of ordinary skill in the art to map the suggested range of M_i to the interval [0,1].

Additionally,

The algorithm, upon which the Konstantinides et al.'s disclosed system is based, is a method of JPEG compression further comprising:

c. Forming a global quantization matrix Q (denoted Q_e by Konstantinides et al.) by one of:
   i. Selecting a standard JPEG quantization matrix table. See column 8, lines 18-22 of Konstantinides et al.
   ii. Selecting a quantization table such that the magnitude of each quantization matrix coefficient Q_{ij} is inversely proportional to the importance in the image of the corresponding DCT basis vector. See Konstantinides et al. Figs. 2 and 3, column 7, lines 45-51, and column 8, lines 18-22.

d. Selecting a linear scaling factor S_{ij} defining bounds over which the image is to be variably quantized. Note that Konstantinides et al. use $qsale_i$ to denote this linear scaling factor. See Konstantinides et al. Figs. 2-3 and column 7, last paragraph. S_{ij} and $qscale_i$ will be used interchangeably throughout this document.

While Konstantinides et al. do teach quantizing the transform coefficients, Y_i, by an equivalent of dividing them by matrix element $Q_e[j,k]$ to obtain quantized transform coefficients, $Y_{Qei}[j,k]$ (see Konstantinides et al. column 5), where it is understood that Q_e, in this case, is the result of scaling the original Q_e by the scalars $quale_i$ (see Konstantinides et al. Figs. 2 and 3, and column 8, lines 25-27), they do not teach utilizing a user-selected scaling factor, such as S_{min}, in the manner of item (e) in claim 1.

9. Yovanof et al. disclose the usage of a user-selectable scalar (referred to as the Q-factor by Yovanof et al.) that is used to scale the quanization matrix (referred to as the Q-table in Yovanof et al.), in a manner similar to the S_{min} of the applicant or the $qscale_i$ of Konstantinides et al. See Yovanof et al. column 5, lines 15-20. It should be clear that modifying the compression method of Konstantinides et al. to provide for a user-selectable scalar, such as the one suggested by Yovanof et al., would be a trivial enterprise for one of ordinary skill in the art. Since the scaling factor is indirectly related to the compression ratio and directly related to the quality of the compressed image (Yovanof et al. column 5, lines 15-17), providing a user-selectable scalar to scale the quantization matrix, advantageously gives the user the freedom to manually control the inherent tradeoff between compression ratio and compressed image quality. Given this advantage and the simplicity of such a modification, it would have been obvious to one of ordinary skill in the art, at the time of the applicant's claimed invention, to utilize a user-selectable scalar, such as the Q-factor of Yovanof et al., in lieu of the scalar $qsale_i$, used in the compression algorithm taught by Konstantinides et al, during the quantization of the transform coefficients. Taking this into account and the discussion above, it is clear that the teachings of Yovanof et al. and those Konstantinides et al., when combined in the manner just described, address claim 1, item (e).

10. The algorithm obtained by the teachings of Konstantinides et al. and Yovanof et al., combined in the manner discussed above, is a method of JPEG compression further comprising:

f. Entropy encoding quantized coefficients T_{ijmn} and $Q*S_{min}$ to create a JPEG image file. See the discussion above, with respect to Yovanof et al.'s Q-factor. See also Fig. 3 of Konstantinides, et al. Note in Fig. 3 that the output of the quantizer 18 (i.e. the quantized transform coefficients, $Y_{Qci}[j,k]$ – the output of multiplier 52) and the output of the scale computer 62 are both fed to the entropy encoder 20.

Thus, it has been shown that the teachings of Konstantinides et al. and Yovanof et al., when combined in the manner discussed above, address all aspects of claim 1.

11. *The following is in regard to claim 3.* The teachings of Konstantinides et al. and Yovanof et al., as combined in the manner discussed above, yield a method, in accordance with claim 1, that further includes calculating a linear scaling factor $S_{ij} = I_{ij}*(S_{max} - S_{min}) + S_{min}$ where S_{min} and S_{max} are user specified to define bounds

over which the image will be variably quantized. See the last paragraph of column 7 in Konstantinides et al. Note in particular the equation for $qscale_i$. With regard to claim 2, observe the following from this equation.

a. $qscale_i$ is clearly linear (piecewise linear).

b. As mentioned above, M_i is analogous to I_{ij}.

c. a and b are user-selected, as implied by Konstantinides et al. in column 7, lines 65-67.

d. As mentioned above, $qscale_i$ determines the degree of quantization of the transform coefficients.

e. a and b define the bounds of $qscale_i$ and, hence, the magnitude of quantization.

Note that b can be trivially chosen to be S_{min}. Furthermore, any arbitrarily chosen a can be expressed as $a = (S_{max} - b)$ and, if $b = S_{min}$, then $a = (S_{max} - S_{min})$[†]. In this case, $qscale_i$ would have a form similar to the linear scaling factor of claim 3.

12. *The following is with regard to claim 8.* Note that the image compression system proposed by Konstantinides et al. implements an image compression algorithm that is JPEG compliant (Konstantinides et al. column 2, last paragraph). It is well known in the art that the default format for color image data, according to the JPEG standard, is YUV (see, for example, Konstantinides et al. column 8, lines 33-36). Furthermore, the chrominance channels (UV) of the input image are typically subsampled with respect to luminance channel (Y). It should be clear that, in order to be practically applied to a YUV image, the various steps of the JPEG compression algorithm (e.g. DCT, quantization, etc.) must be performed each of the color channels. Therefore, in light of the discussion above with regard to claim 1, the combined teachings of Konstantinides et al. and Yovanof et al. address the following aspects of claim 8.

A method of JPEG compression of a color image represented by channels Y for grayscale data, and U and V each for color, comprising

a. Shrinking (subsampling) the color channels U and V by a fraction of their size;

b. Forming a discrete cosine transform (DCT) D_{ij} for each block B_{ij} of each of channels Y, U and V;

[†] Expressing the coefficient a in this form may particularly useful. It would be apparent to one of ordinary skill in the art that, if M_i is constrained to be within the interval [0,1], as suggested above, then $qscale_i$ would become a linear interpolation between two user-selected values, S_{min} and S_{max}, for $0.4 \le qscale_i \le 2$.

d. Quantizing the transform coefficients for each of the Y, U and V channels by dividing them by a factor S_{ij} Q', where S_{ij} is a linear scaling factor for each of channels Y, U and V and Q' is the quantization table for the associated channel being quantized;

e. Entropy encoding quantized coefficients T_{ijmn} and $Q'*S_{min}$, where S_{min} is a user selected minimum scaling factor for each of channels Y, U, and V, to create a JPEG image file for each of channels Y, U and V.

13. With regard to item (c), calculating a visual importance, I_{ij}, for each Y channel block of each image and setting I_{ij}=max{I_{ij} values for corresponding Y channel blocks} for blocks in the U and V channels, note the following. In the compression algorithm implemented by the compression system of Konstantinides et al., the activity metric (visual importance) is calculated for each Y channel block of the image and applied to the associated UV blocks (Konstantinides et al. column 8, lines 41-43). This can be trivially extended to deal with a subsampled image, where for each subsampled chrominance block (UV) there may be multiple corresponding luminance blocks (Y). Clearly, when confronted with such a situation, one of ordinary skill in the art, in an effort to preserve image quality, would select, among the multiple Y blocks, the block with highest visual importance (activity measure). One could then extend the teachings of Konstantinides et al. to subsampled images by calculating the activity metric for each Y block associated with the given UV blocks and applying to those UV blocks the maximum of the activity metrics calculated for the associated Y blocks. Konstantinides et al. also addresses item (d) of claim 8 (forming a global quantization matrix Q for the Y channel block and one for channels U and V combined such that a magnitude of each quantization matrix coefficient Q_{ij} is inversely proportional to an importance in the image of a corresponding DCT basis vector). This follows from the preceding discussion and the one presented above for item (c,ii) in claim 1. Thus, it has been shown that the teachings of Konstantinides et al. and Yovanof et al., when combined in the manner discussed above, can be trivially extended by one of ordinary skill in the art so as to address all aspects of claim 8.

14. *The following is with regard to claim 9.* The chrominance components of YUV images that are JPEG compressed are typically subsampled at a 2:1 ratio with respect to the luminance component. Given this, it would have been obvious for one of ordinary skill in the art to subsample the chrominance components of the input image

at a 2:1 ratio relative to the luminance component in the JPEG compression method, obtained by the teachings of Konstantinides et al. and Yovanof et al, when combined in the manner discussed above with respect to claim 8.

15. *The following is with regard to claim 10.* The apparatus of applicant's claim 10 is an implementation of the method of claim 1. Therefore, with regard to claim 10, arguments analogous to those presented for claim 1, are applicable. In addition, with regard to item (d) of claim 10, arguments analogous to those presented for claim 3 are applicable.

16. *The following is with regard to claim 12.* The apparatus of applicant's claim 12 is an implementation of the method of claim 3. Therefore, with regard to claim 12, arguments analogous to those presented for claim 3, are applicable.

17. Claim 4 is rejected under 35 U.S.C. 103(a) as being unpatentable over Konstantinides et al., in view of Yovanof et al. as applied to claim 1 above, and in further view of Memon et al. (U.S. Patent Publication 2001/0043754A1).

18. *The following is with regard to claim 4.* As shown above, the compression method obtained from the teachings of Konstantinides et al. and Yovanof et al., as combined in the manner discussed above, yield a method, in accordance with claim 1. However, in such a method, the visual importance, I_{ij}, is *not* determined by discrete edge detection and summation of transform coefficients.

19. Memon et al. show a JPEG compliant compression algorithm (Memon et al., paragraphs [0026] and [0040]) wherein a visual importance is determined by discrete edge detection and a simple activity measure computed for each block. See Memon et al., Fig. 4 and paragraphs [0038] and [0053]-[0060]. See also Memon et al. paragraphs [0013]-[0021] for a related discussion. Note there that edges are detected in the block classification scheme of Memon et al. The visual importance, in this case can be regarded as the classification of the block in combination with the simple activity measure associated with that block. Memon et al. do not show how the block activity measure is derived, however, it would be understood by one of ordinary skill in the art that the activity measure, M_i, given by Konstantinides et al. (Konstantinides et al., column 6), or the activity metric, A, given by Yovanof et al. (Yovanof et al., column 6), would suffice. In either case, a summation of the transform coefficients is computed. Modification of the compression method obtained from the combined teachings of Konstantinides et al.

and Yovanof et al. to incorporate the block classification taught by Memon et al. would be straightforward to one of ordinary skill in the art, since: (a) all three methods are based on the JPEG standard, and (b) the block classification would only effect the computation of the scaling factor (e.g. as in reference number 350 of Fig. 3 of Memon et al., reference number 62 of Fig. 3 of Konstantinides, et al., or reference number 318 of Yovanof et al.). The motivation to perform such a modification is that the perceptual classification scheme proposed by Memon et al. provides additional flexibility in adapting the quantization table scaling factor to the perceptually distinct portions of the image, while maintaining computational simplicity. This flexibility allows for the reduction of artifacts in JPEG compressed images. See Memon et al. paragraph [0026]. Given the relative ease of such a modification and its apparent advantage, it would have been obvious to one of ordinary skill in the art, at the time of the applicant's claimed invention, to incorporate the perceptual block classification scheme described by Memon et al. into the compression method obtained by combining, in the manner discussed above with regard to claim 1, the teachings of Konstantinides et al. and Yovanof et al. In doing so, one would obtain a method according to claim 1, where the visual importance of a block is determined by discrete edge detection and summation of transform coefficients. This is in accordance with claim 4.

Allowable Subject Matter

Objections, Allowable Subject Matter

20. Claims 2, 5, 6 and 11 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims

21. Claim 6 would be allowable if rewritten to overcome the rejection(s) under 35 U.S.C. 112, second paragraph, set forth in this Office action and to include all of the limitations of the base claim and any intervening claims.

Allowable Subject Matter

22. Claim 7 is allowed.

23. The following is a statement of reasons for the indication of allowable subject matter.

24. *The following is with regard to claim 2, 7 and 11.* The combined teachings of Konstantinides et al. and Yovanof et al. can be shown to address item (a) of claim 2 and the rounding (D_{ijmn} / (S_{min}*Q)) to the nearest integer to form quantized transform coefficients, also of claim 2. However, item (b) is not shown in either of these references. Essentially, item (b) of claim 2 claims the quantization of the transform coefficients by assigning them to quantization levels that are integer powers of 2, when the error of this method of quantization is less than or equal to the error the standard quantization technique (e.g. $T_{ijmn} = D_{ijmn} / (S_{ij} * Q)$ or $Y_{Qei}[j,k] = Y_i[j,k] / Q_e[j,k]$, as in Konstantinides et al.). It should be noted that the usage of quantization levels that are integral powers of two is not unique. Juri et al., for example, teach the usage of adaptive quantization within a video compression, similar in principle to JPEG, wherein the quanitizing width of the transformed coefficients (Juri et al. Fig. 1 reference number 4), corresponding to an 8×8 block (Juri et al. column 6, lines 25-32) of a video frame, is varied so that transformed coefficients corresponding to less visually important image data are quantized using a larger quantization width (Juri et al. Abstract). That width varies as 2^i, where $i \in Z$ is the minimal number of bits required to express the transformed coefficient being quantized as a binary number. The quantization proposed in item (b) of the applicant's claim 2 accomplishes essentially the same result. However, the quantization of the transform coefficients shown by Juri et al. differs from that of item (b) in the applicant's claim 2, in that the applicant actually sets the quantized coefficient T_{ijmn} to a value having a form similar to 2^i, whereas Juri et al. divide the transform coefficient by 2^i to obtain the quantized transform coefficient. This discussion is applicable to claim 7 and 11.

25. *The following is with regard to claim 5.* As shown above, in regard to claim 4, evaluating the visual importance of an image block based on some form of edge detection exists in the prior art. Convolution with an edge-tracing kernel is known in the art as a means for edge detection. However, utilizing such an edge detection technique and summing center 10×10 matrix values of said convolution to produce a summed value, and normalizing said summed value to produce a visual importance, is unique and non-obvious.

26. *The following is with regard to claim 6.* While techniques for generating quantization matrices abound in the prior art, the applicant proposes a unique and non-obvious approach in claim 6.

Citation of Relevant Prior Art

27. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure:

a. U.S. Patent 5,481,309, Juri et al., "Video Signal Bit Rate Reduction Apparatus Having Adaptive Quantization". Juri et al. teach the usage of adaptive quantization within a video compression, similar in principle to JPEG, wherein the quanitizing width of the transformed coefficients (Juri et al. Fig. 1 reference number 4), corresponding to an 8×8 block (Juri et al. column 6, lines 25-32) of a video frame, is varied so that transformed coefficients corresponding to less visually important image data are quantized using a larger quantization width (Juri et al. Abstract). That width varies as 2^i, where $i \in Z$ is the minimal number of bits required to express the transformed coefficient being quantized as a binary number. This is similar in principle to quantization proposed in item (b) of applicant's claim 2 and 11and item (e,iii) of claim 7.

b. "An Adaptive Perceptual Quantization Algorithm For Video Coding", Chun et al., IEEE Transactions on Consumer Electronics, Vol. 39, No. 3, August 1993. This article shows a perceptual block classification scheme similar to that of Memon et al. and, therefore, addresses applicant's claim 4.

c. "A JPEG Variable Quantization Method for Compound Documents", of Konstantinides et al., IEEE Transactions on Image Processing, Vol. 9, No.7, July 2000. This article contains a more detailed treatment of several aspects of the invention disclosed by Konstantinides et al. in U.S. Patent 6,314,208.

d. "Information Flow if Non-Uniform Differential Quantization", Dusan Agrez, Instrumentation and Measurement Technology Conference, 1999. IMTC/99. Proceedings of the 16th IEEE, Volume: 3, 24-26 May 1999 Pages: 1667 - 1672 vol.3 This article shows a non-uniform quantization technique employing variable quantization widths, where those widths are varies proportionally to a powers of two. See section 2 and Fig. 4.

e. "JPEG Still Image Data Compression Standard", 1st Edition 1993. Pennebaker, W. and Mitchell, J. The book provides a thorough treatment of the JPEG standard.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Kevin Siangchin whose telephone number is (703)308-6604. The examiner can normally be reached on 9:00am - 5:30pm, Monday - Friday.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Amelia Au can be reached on (703)308-6604. The fax phone number for the organization where this application or proceeding is assigned is (703) 872-9306.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703)306-0377.

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